BEER IN THE MAKING.

Processes Through Which the Malt and Other Ingredients Pass.

The Wonders of Mechanical Ingenuity Employed.

Modern Methods of Brewing About Which Little Is Generally Known.

New York makes one-third more beer than it drinks, yet there was drunk last year 124 quarts of the amber nectar to each man, woman and child of the 1,700,000 people found—and counted—by the police census takers.

As the average "glass of beer" is not more than one-third of a quart, apparently everybody in the metropolis, from the babe in arms to the frosty grandsire, indulged in a glass of Gambrinus's favorite beverage every week day in the year and twice on Sundays.

A MASH TUN.

Lager beer was first brewed in America less than fifty years ago by a German named Wagner. His brewery was a shanty in Philadelphia. A humble beginning of a business in which to-day there are millions of dollars invested in New York City alone.

The methods employed in brewing the German beverage have advanced scientifically in pace with the growth of the traffic, and to-day a lager-beer brewery is a vast institution replete with the triumphs of inventive skill.

Few people know the processes through which the malt, the hops and other ingredients of beer pass before the foaming schooner is set before them by the kellner at the rathskeller.

Every brewery has a cosy room set apart as a "Bierstube," where all visitors to the establishment are entertained and filled to the brim, if they like, with lager, free from cost, be they friends or strangers.

The "Bierstube" is about as far as the visitor generally gets or cares to get, physically or mentally. But beyond there is a strange world, a very wonderland.

AN EVENING WORLD reporter recently visited one of New York's greatest breweries, near Hell Gate. The brewer is several times a millionaire, and the brewery covers seventy-five city lots. The reporter passed from the "hospitium" into the great brewery, and witnessed the various processes employed in brewing lager beer.

Let us consider the malt first. Everybody knows that the malt is made from barley. It is obtained, however, by a four-fold process. The grain, having been threshed free from the husks, is run through a farmer's ordinary fanning mill, by which process the loose husks are blown out of the grain.

INTERIOR OF MASH TUN.

Then the grain is steeped, in order to cause germination and separate the saccharine and gummy substances of the barley, and by which the starch is converted to that saccharine matter, the primary essence of beer.

It is next flavored, and left to sprout and germinate. Then it must be subjected to kiln-drying, which ends the germination.

All this is done before the malt is malt. Then it goes to the brewery, is carefully weighed, is sifted, screened and the lightweight grains blown out of it, and stored away in giant bins holding thousands of bushels each.

The brewer begins his work in the top of the house and gradually works downstairs in the several processes of the brew.

When the brewer is ready to begin a brew the requisite amount of malt is taken from the bins and subjected to a series of siftings, screenings and blowings by which all germs, dust and other harmful and useless matter is separated from the malt.

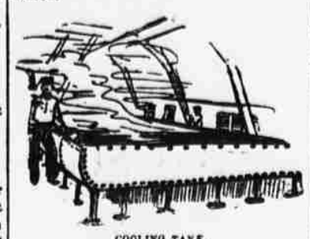
INSPECTING HOPS.

The chutes through which the malt is made to pass are studded inside with powerful magnets that draw and detain nails, bits of iron, and, in fact, any metallic substance that may be in the malt. The presence of a bit of metal or an excess of germ or dust will surely spoil the wort.

The malt next passes to the metal rollers, and John Barleycorn is "crushed between two stones," as related by Bobby Burns in his poem.

The crushed malt is weighed again, for successful brewing depends upon the proper proportion of the ingredients of the brew. Then it goes into a preliminary mash-tun, a mammoth vat in which the malt is thoroughly mixed with water of a prescribed temperature.

This is to extract from the malt the saccharine substance and dextrine contained in it, and to convert into dextrine and maltose the residue of the unconverted starch.



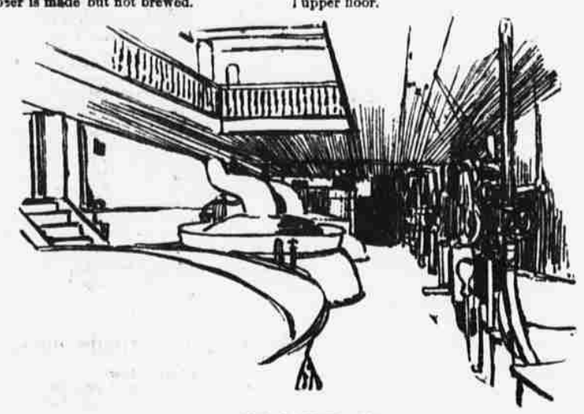
COOLING TANK.

In the modern New York brewery the work up to this point has been done almost entirely by machinery, not labor-saving machinery, but machinery calculated to reduce the operation to absolute perfection and precision, so that to-day's and to-morrow's brew and the brew of a year hence will be exactly alike.

In the brewery visited by the reporter there were three mashing tuns of iron, set in frames of wood rising four or five feet from the floor, and the malt was introduced by chutes from the first mash tun.

Mashing is done by the motion of a number of raking contrivances within the tubs. They revolve in opposite directions around central pivots, mixing every particle of the grain as it drops from the "vormaisch-bottle" on the floor above.

The brewmaster is now on the alert. He watches the mash every instant. He must watch the temperature of the water with which he mixes his malt, gauge the effect of the heat, and know at a glance when to open the valves of the tun and draw off the wort. A saccharometer indicates to the brewer the proportion of sugar in the wort, and when the wort is ready to draw off the beer is made but not brewed.



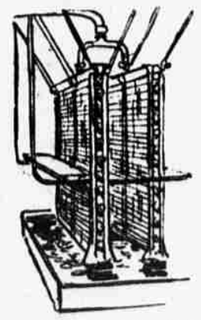
IN THE BOILING KETTLE ROOM.

It is still unfermented, and the process is only just begun. At the opportune moment the brewer opens the valves and the sugar-laden liquid passes through pipes and a filtering apparatus down into the "copper" or boiling kettle below.

While this is going on, the brewer has set in motion the "sparging" machine. It sends a constant fine shower of water on the still revolving, mashing mess of grain in the tun, washing out all that remains of goodness in the malt and making a large saving to the provident brewmaster.

Descending with the brewer to the floor below, the visitor enters the brewroom and is struck with the probable accuracy of the old saying that when a brewer has nothing to do he polishes up his utensils. Here the copper kettles shine resplendent, and a perfect forest of pipes from the floor above reflect one's image on every hand.

The liquid that has come down from the mashing-tubs into the coppers contains all of the ingredients of the "body" of the beer. The extract of a highly nutritious grain, it is "liquid bread."



SECOND STAGE OF COOLING.

All the nourishing qualities of the grain are not yet extracted, however, and the brewer sells the malted and mashed grain to dairymen, for it makes splendid food for cattle, producing rich milk and inducing a large yield of milk.

But to return to the brew. The coppers have covers with small sliding doors, and they are never opened during the boiling save to enable the brewmaster to make his tests. The heat for the boiling is furnished by steam boilers which send a continuous current of steam through coils fixed in the coppers.

And now, after a sufficient boiling, the hop is added to the wort—the bitter to the sweet. The boiling of the wort has usually been going on for three hours when the brewmaster empties several large sacks of aromatic hops into the copper, and an hour later the boiling is complete.

The hops added to the wort transform fermented barley juice, a drink that was known to most of the ancient nations, into beer.

Hops form the preservative of beer. Without this tender plant beer could not be preserved for any length of time, and its flavor would be inferior to the popular drink of the day.

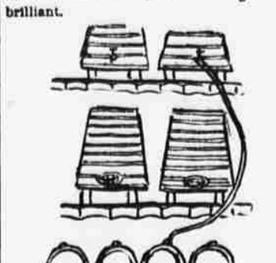
The hops are delivered at the brewery packed in large bales, each weighing 180 pounds. The brewer breaks the hop cones into fragments by an ingenious machine invented for the purpose. They have been carefully selected by the buyer, who has looked to it that the hops have a proper proportion of the qualities desired.

The principal substances which the hop cone yields when boiled are lupulin and tannin. After the hops are broken up they are placed loosely in large canvas bags, carefully weighed, and then, at the proper moment, dropped into the boiling-copper.

The boiling completed, the brewer descends to a still lower floor, the visitor following. Here is a labyrinth of machinery. There are engines, pumps and other gear, and directly under the boiling-copper is a large, black rectangular tank. It is connected with the boiling-copper and is called a "hop-back" or "hop-retainer."

Inside this tank is a sieve or perforated false bottom. The contents of the boiling-copper is run into the hop-back, the sieve stops the hops and the wort passes on through the sieve into the real bottom of the black tank.

Now the brewer is in the biggest kind of a hurry. He is hurrying the wort to the cooling tank as rapidly as possible, for it must reach its destination bright and brilliant.



CLARIFYING.

As the cooling tank is away up on the top floor, poor John Barleycorn must need travel back up the three flights of stairs.

The wort is allowed to settle in the hop-back twenty minutes. Then it is pumped up through a set of pipes to a tank on the upper floor.

It comes up with a hiss and a roar, for it is steaming hot. The cooling tank in the brewery visited is in the form of a rectangular pan, 30 by 42 feet in dimensions. It has a capacity for 1,175 barrels of the steaming liquid. It is at the very top of the building, and there are wide latticed windows for the admission of the air.

STORAGE CASKS.

The liquid must now be reduced in temperature sufficiently to make it amenable to the action of the yeast, which he must next add to it, and thus prepare it for fermentation.

This must be done quickly, or the wort will turn sour through exposure to the open air, and the desired result is produced in various ways. The old German brewer thinks he must have "fel senkeller," or "rock cellar," a deep cavern in the earth.

Most American brewers cool the wort in a refrigerator. At the brewery under consideration the rock cellar is on the roof, and the refrigerator for most of the year is the free air of heaven.

From the cooling tank on the roof the wort is conveyed through pipes to another pan, whence it trickles over two refrigerators. These refrigerators are on separate floors, one above the other.

The upper one is supplied with water from an artesian well; the second refrigerator over which the work passes reduces the temperature of the liquid to 40 degrees Fahrenheit by the De La Vergne machine process, the rapid expansion of a compressed gas and volatilization of certain liquids by chemical process.

The wort having reached the temperature most suitable for the beginning of fermentation, it passes into the fermenting vats.

RACKING.

A pound of yeast for every barrel of the wort is now put in, and this induces fermentation at once, the process that gradually converts the saccharine principle into alcohol and carbonic acid gas, and places the beer in the category of intoxicating beverages.

The fermenting-room is in the very subcellar of the great brewery. It is absolutely dark and as cold as Greenland.

The cellar master is in charge here, and he turns on a score of electric lights distributed about the cellar, and reveals almost endless vistas of huge tanks. John Barleycorn has come down off his lofty perch again, and here he must stay till his unfermented character has been corrected under the watchful eye of the cellar master.

HOT WATER VAT.

The conversion of sugar into alcohol must be slow. If fermenting runs too rapidly, by reason of defective yeast or unsuitable temperature, attemporators must be brought into play and coils of pipe connected with the refrigerating plant must be placed in the vats.

Inventive genius has reduced this part of the brewing to a science. By a light pressure of the hand, the turning of a small wheel, the pressing of a button, the brewer is enabled to regulate the temperature of these oceans of turbuient, foaming liquids.

These fermenting tuns are of Titanic proportions. They hold three hundred to four hundred barrels.

The workmen seem mere pygmies. While the fermentation is progressing they clamber up ladders to the tops of the vats, skim the beer with huge ladles, tasting and touching the liquor in tests, in order to determine when to draw it off into the resting tuns.

When the fermentation has gone far enough the beer is drawn off into the resting tuns by hydraulic and air pressure, the only manual labor involved being the turning of cocks and faucets or depressing levers.

These resting vats are three stories underground, and the weather is stinging cold. The walls and ceiling are festooned with ice to the depth of three to five feet, and every vat is thickly incrusted with frost.

When the fermentation is completed the wort has been transformed into beer. But it is not yet "lager" beer. It must pass through several processes yet before it is fit for use.

It must rest for a time in the resting vat. Then it is tranferred to the storage casks, where the process of fining takes place.

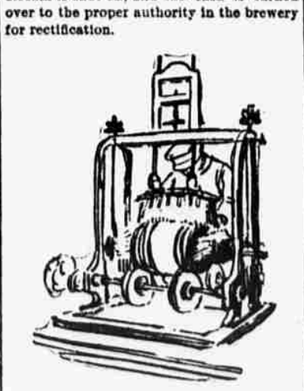
The beer is fined by the use of chips or shavings, usually cut from beechwood. In fermenting the beer has become muddy, and small particles are in the liquid. The beechwood chips attract these particles. They cling to the chips, and thus the beer is fined as it is drawn off into the storage kegs.

Concurrently, the process of krausening takes place. Large quantities of carbonic acid gas has escaped from the casks and vats, and a second fermentation must be produced to re-enliven the beer. This is done at this time by adding one-fifth of new beer to the old, through pipes connecting with the fermenting vats.

The beer having passed from the vats into the storage casks must remain to "lager" on the lagers or frames for the purpose from five to eight months, when it takes another winding journey through miles of pipes, emerging bright, clear and brilliant into the racking room.

The racking begins. The men attach their bits of hose to the faucets, turn on the beer, and the beer flows through the hose to the kegs, one after another, in delicious amber color. Other men close up the kegs by driving the bungs in as rapidly as they are filled.

Each bit of hose has a glass tube at the lower end, enabling the racker to detect any change in the color or clearness of the beer, and when anything wrong is detected, the stream is shut off, and the cask is turned over to the proper authority in the brewery for rectification.



SCRUBBING KEG.

When the beer is racked and the kegs filled, Government tax stamps are pasted on the spigots, the kegs are loaded into the waiting delivery wagons, and the beer goes out into the world to cheer and comfort the thirsty.

All kegs are thoroughly cleansed when they return empty from the retailer, and 100 barrel-washing machines are in use in one brewery. The kegs are washed with hot water inside and out.

The operation is automatic. All the workman has to do is to place the keg over a contrivance consisting of an upright spout that passes in at the bunghole, and turn on the water that comes with much force through a main pipe, four arms holding it in place.

The outside of the kegs is washed by a scrubbing machine, which turns the keg by a mechanical device and scrubs it with a stiff brush.